R E P O R T R E S U M E S

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COMPUTER ASSISTED INSTRUCTION.
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PROVIDENCE COLL., R.I.
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DESCRIPTORS- *COMPUTER ASSISTED INSTRUCTION, *CURRICULUM GUIDES, *LESSON PLANS, *COMPUTERS, TEACHERS, *INSERVICE TEACHER EDUCATION, PROVIDENCE, COURSEWRITER

A COURSE IN THE USE OF COMPUTER-ASSISTED INSTRUCTION WAS GIVEN FOR 20 TEACHERS OF VOCATIONAL EDUCATION AND NINE TEACHERS OF MENTALLY HANDICAPPED. THE OBJECTIVES OF THE COURSE WERE (1) TO DEVELOP A GROUP OF VOCATIONAL TEACHERS WHO WOULD UNDERSTAND COMPUTER-ASSISTED INSTRUCTION AND WHO WOULD BE PROFICIENT IN "COURSEWRITER" TECHNIQUES FOR CONVERTING INDIVIDUAL LESSONS INTO THE PROPER FORMAT FOR COMPUTER-ASSISTED INSTRUCTION, AND (2) TO PREPARE SAMPLE LESSONS FOR COMPUTER-ASSISTED INSTRUCTION IN A VARIETY OF VOCATIONAL COURSE AREAS. THE 6-WEEK COURSE INCLUDED (1) OPERATION OF THE "COURSEWRITER," (2) "COURSEWRITER" LANGUAGE AND PROCEDURES FOR LESSON PREPARATION, AND (3) PSYCHOLOGY UNDER THE GUIDANCE OF A PROGRAMER, A PSYCHOLOGIST, AND A VARIETY OF CONSULTANTS. DURING THE FINAL PHASE, THE ENROLLEES ACTUALLY PLANNED, DESIGNED, WROTE, AND TRIED OUT SAMPLE LESSONS FOR COMPUTER-ASSISTED INSTRUCTION IN THEIR RESPECTIVE VOCATIONAL COURSE AREAS. THE ENROLLEES' COMMENTS AND REACTIONS CONCERNING THE SUMMER TRAINING PROGRAM WERE QUOTED AND SUMMARIZED IN THIS REPORT. THE REPORT INCLUDES DESCRIPTIONS OF (1) THE OPERATION OF COMPUTER EQUIPMENT, (2) ADVANTAGES OF COMPUTER-ASSISTED INSTRUCTION, AND (3) GUIDELINES FOR THE COURSE, AND FOUR PROGRAMED LESSONS. (TC)

ED012385

Final Report
Project No. 5-0014

COMPUTER ASSISTED INSTRUCTION

R. I. State Dept. of Vocational Education

in cooperation with

Providence College

U. S. Office of Education

Contract

OE - 5 - 85 - 105

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Project: 335

Title: Computer Assisted Instruction

Director: G. C. McGregor, O.P.

Instructors:

Psychology . . . . Edward J. Nolan, Ph.D.

Programming . . . Richard Alphin, A.B., M.B.A.
(Mr. Alphin is with IBM)

Students:

Vocational Education 20

Mentally Handicapped 7

SELECTION OF STUDENTS

Notices were sent to all of the schools in Rhode Island which have Vocational classes and to a few of the schools in nearby Massachusetts. It was pointed out in the letter that prerequisite for the course was the taking of the IBM Programmers Aptitude Test.

There were 94 teachers of Vocational Education who took the test. The 30 highest were called in for an interview and 20 of this group were chosen as participants.

Selection of teachers of the Mentally Handicapped was carried on in the same manner.

The stipends for the teachers of the mentally retarded were paid under a Cooperative Research Grant, Project Z013, United States Office of Education.

TEACHERS OF VOCATIONAL EDUCATION

Robert G. Brooks	Cranston High School	Cranston, R. I.
Wilfred J. Charette	Warren High School	Warren, R. I.
Joseph DeFusco	Pilgrim High School	Warwick, R. I.
Joseph A. Depasquale	Vocational Tech. School of R. I.	Providence, R. I.
Edward A. DeSanto	Vocational Tech. School of R. I.	Providence, R. I.
George J. Grant	Pawtucket Vocational High School	Pawtucket, R. I.
Edward V. Hogan	Cumberland High School	Cumberland, R. I.
Chace E. Loomis, Jr.	Barrington High School	Barrington, R. I.
Charles McGonagle	Hope High School	Providence, R. I.
Arthur Montanaro	Coventry High School	Coventry, R. I.
Amato J. Nocera	Warren High School	Warren, R. I.
Americo A. Ottaviano	Vocational Tech. School of R. I.	Providence, R. I.
James J. Rennick, Jr.	Dighton-Rehoboth Regional H.S.	Rehoboth, Mass.
Robert R. Reynolds	Tolman High School	Pawtucket, R. I.
Gerald W. Ridge	Vocational Tech. School of R. I.	Providence, R. I.
Edward P. Sherlock	Pawtucket Vocational High School	Pawtucket, R. I.
Allen F. Swann	Pilgrim High School	Warwick, R. I.
Raymond Szeflinski	Coventry High School	Coventry, R. I.
Frank R. Walker, III	Vocational Tech. School of R. I.	Providence, R. I.
Lucy D. Medeiros	R. I. Junior College	Providence, R. I.

TEACHERS OF MENTALLY HANDICAPPED

Charlotte M. Brothers 48 Jastram Street Providence, R. I.	Webster Avenue School 191 Webster Avenue Providence, R. I.
Thomas Depari 75 Sixth Avenue Woonsocket, R. I.	Central High School 170 Pond Street Providence, R. I.
George F. Marks 94 Calla Street Providence, R. I.	T. A. Doyle School Doyle Avenue Providence, R. I.
Thomas F. McKenna 60 Waverly Street Providence, R. I.	Gilbert Stuart Jr. High School Princeton Avenue Providence, R. I.
John F. McKeon 185 Albert Avenue Cranston, R. I.	Central High School 170 Pond Street Providence, R. I.
John J. McLaughlin 119 Norwood Avenue Cranston, R. I.	Nathanael Greene Jr. High School Chalkstone Avenue Providence, R. I.
Leo J. Rivers 37 Kelly Avenue Rumford, R. I.	Jenkins Street School Jenkins Street Providence, R. I.

COLLEGE	STUDENTS
R. I. Junior College, Providence, R. I.	1
HIGH SCHOOLS	
Barrington High School, Barrington, R. I.	1
Central High School, Providence, R. I.	2
Coventry High School, Coventry, R. I.	2
Cranston High School, Cranston, R. I.	1
Cumberland High School, Cumberland, R. I.	1
Hope High School, Providence, R. I.	1
Pilgrim High School, Warwick, R. I.	2
Tolman High School, Pawtucket, R. I.	1
Warren High School, Warren, R. I.	2
OUT OF STATE HIGH SCHOOL	
Dighton-Rehoboth Regional High School, Rehoboth, Mass.	1
VOCATIONAL HIGH SCHOOLS	
Pawtucket Vocational High School, Pawtucket, R. I.	2
Vocational Tech. School of Rhode Island, Providence, R. I.	5
JUNIOR HIGH SCHOOLS	
Gilbert Stuart Jr. High School, Providence, R. I.	1
Nathanel Greene Jr. High School, Providence, R. I.	1
ELEMENTARY SCHOOLS	
T. A. Doyle School, Providence, R. I.	1
Jenkins Street School, Providence, R. I.	1
Webster Avenue School, Providence, R. I.	1
SUMMARY	
Barrington, R. I.	1
Coventry, R. I.	2
Cranston, R. I.	1
Cumberland, R. I.	1
Pawtucket, R. I.	3
Providence, R. I.	14
Warren, R. I.	2
Warwick, R. I.	2
Rehoboth, Mass.	1

COMPUTER ASSISTED INSTRUCTION

A relatively new method of instruction with many of the advantages of the individual-student instruction is called COMPUTER ASSISTED INSTRUCTION. This method allows the instructor to use the computer as a means of disseminating instruction to a number of students individually.

Pioneering studies in computer assisted instruction were started in 1958 by Gustave J. Rath, Nancy S. Anderson, and Richard C. Brainerd. They investigated the use of a computer and a typewriter to teach binary arithmetic. In these preliminary studies, only one typewriter terminal was used, and instructions to the students were given orally by the instructor rather than by the computer.

The present concept of computer assisted instruction evolved from a system developed by William R. Utal in 1961. Experiments were performed with a modified IBM 650 Data Processing System and specially designed electrical equipment to connect the student stations to the computer.

Present systems usually consist of standard equipment such as:

1. Large-capacity storage units
2. A central processing or computing unit
3. A transmission control unit or message "traffic" regulator
4. A buffer or temporary storage unit
5. Student teaching stations

The large-capacity storage units are IBM 1311 Disk Storage Drives, which store the entire contents of the course material along with individual and class performance records and other bookkeeping information. Each section of storage contains an address so that course material can be retrieved from any area of storage.

The processing unit acts as an intermediary between the student and the course material stored in the disk storage units. For example, it retrieves questions from the storage units and presents them to the student through the typewriter, compares the student's answers with all possible answers listed by the instructor, and then follows with appropriate instructions, such as "present next question" or "recommend remedial reading".

While the computer is working on one student's problem, responses from other students are temporarily stored in a buffer memory. The traffic of messages between students and computer is directed by transmission control unit. Because the system handles messages so rapidly, each student feels that the computer is working for him only.

Computer assisted instruction generally follows the pattern of programmed instruction, but represents a significant advance over previous forms of this learning concept. Researchers have used computer assisted instruction to explore a number of techniques that represent major advances over earlier approaches to programmed instruction.

ADVANTAGES OF COMPUTER AIDED INSTRUCTION

What, specifically, will education gain by installing a real-time computerized instruction system? The following are some of the benefits (objective):

1. Individual Differences Will Be Considered.

Slow and fast students will be allowed to proceed at their own rate. Our present system is geared to the average student (even the accelerated classes are geared to the "average" accelerated student). The system will adjust to the individual, not the individual having to adjust to the system. The computer is much more patient than most teachers.

2. Free Teacher from Information Transmission.

Automated instruction will free the teacher from many of his present day tasks, information transmission being a primary consideration. This will allow the teacher more time for extending student understanding, stimulating student creativity, challenging student imagination, providing help and counsel, and socialization. To repeat what was mentioned earlier, many educators feel that this will be a more difficult and demanding role which will be welcomed by the teacher.

3. Free Teacher of Clerical Work.

According to some educators, the teacher spends at least a third of his time not in teaching. He acts as host, clerk, librarian, counselor, housekeeper, decorator, ticket seller, attendance taker, data processor, analyzer, and policeman. Introduction of computers will enable many of these activities to be automated. The result will be to allow the teacher more time to perform the functions, discussed in the last paragraph.

4. Permanent Record of Learning Will Be Left.

As a student progresses through a course he will leave a permanent record of his accomplishments. This will provide the instructor information about the student's level of understanding; where students are having difficulty and where more help is needed. Information such as this will also be beneficial to counselors and curriculum developers.

5. Keep Students Active.

Students will be kept active at all times doing such things as reading, answering questions, and manipulating the machine. Contrast this with the single student-teacher interaction so common today.

6. Provide Immediate Feedback.

The computer provides the student immediate feedback in the learning situation. This is extremely vital in efficient learning.

7. Reduce the Cultural Lag in Curriculum.

Today from the time some significant information is published or made known, a great deal of time may pass until it may be incorporated into the school curricula. The advent of the computer in the classroom should greatly reduce this time lag.

COURSEWRITER

As we know it today, a programmed-instruction course presents instructions, questions, answers, and other information to the individual student in a carefully planned sequence (program). Because he actively participates in the course, the student is continuously aware of his progress. Every error he makes is followed immediately with information to help him understand what led him to make the mistake, which he is often required to correct.

In a well-prepared program the student progresses according to his individual capabilities. The more capable student moves faster because he makes fewer errors. The slower student receives the practice and information he needs to aid him in learning. As he grasps the subject, he progresses through the course.

The equipment generally used consists of:

1. Large-capacity storage units
2. A transmission control unit or message "traffic" regulator
3. A central processing or computing unit
4. A buffer or temporary storage unit
5. Student teaching stations

The large-capacity storage units are IBM 1311 Disk Storage Drives, which store the entire contents of the course material along with individual and class performance records and other bookkeeping information. Each section of storage contains an address so that course material can be retrieved from any area of storage.

The processing unit acts as an intermediary between the student and the course material stored in the disk storage units. For example, it retrieves questions from the storage units and presents them to the student through the typewriter, compares the student's answers with all possible answers listed by the instructor, and then follows with appropriate instructions, such as "present next Question" or recommend remedial reading".

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Computer-assisted instruction generally follows the pattern of programmed instruction, but represents a significant advance over previous forms of this learning concept. Researchers have used computer-assisted instruction to explore a number of techniques that represent major advances over earlier approaches to programmed instruction.

COURSEWRITER AN EXPERIMENTAL TOOL

Because the application of computers to instruction is relatively recent, experience with the implementation of educational methodology on data processing systems is limited. Therefore, many questions of effectiveness are difficult to dispose of experimentally. It is thus particularly desirable to undertake research where the scope of the course material is known, the competence involved in taking the course is understood, and the quality of learning can be measured on completion.

Coursewriter programs the data processing system to act as a medium between the instructor and a number of students. Both instructors and students can participate in the course at various locations (local and remote) and at various times or at the same time. With the IBM 1401 or 1440 as the course processing center, an IBM 1050 Data Communications System acts as the communication link between the students and the computer.

Through the Coursewriter, the author writes his course so that each student receives individual instruction. He has a freedom that few teachers possess even in the classroom. He guides his students along the path best suited to each. The advanced student does not cover any material that the instructor feels is unnecessary to his progress or that might be below his level. The slow student reviews important steps that he finds difficult to understand.

TEACHER

The Coursewriter enables the teacher to organize the course however he wishes, evaluating the student's capabilities, learning his background, giving him assignments, asking questions, and then directing him to the parts of the course that best suit him. The teacher may use various sequences of questions, statements, and instructions. He may use the familiar "frames" of programmed instruction, or he may turn to a method of instruction quite dissimilar to it. Not only can he write his course while the students are taking it, but he can also go back and revise immediately if he wishes.

The computer's statistical analysis of the students' reactions gives the author an accurate report of the results of his course. Such reports facilitate his readily revising and improving the course based on actual experience even before the students have completed it.

As he receives the reports he continuously realizes how he can better adapt the course to the individual student. It takes only a few such reports to suggest to the teacher new and varied levels and paths for the students to follow.

STUDENT

The student paces himself, with the knowledge that the program will direct him at the proper time to the part of the course that best suits him.

Students may participate in the course at various times. No prescribed time schedule is necessary. If a student reaches an impasse, he calls for "help" from the computer in the form of the correct answer. The statistical analysis of the student's progress measures his efforts and abilities.

INDEX TO GUIDELINES

1. Objective — Demonstration

2. Liaison Between Instructors

3. CAI As A Tool

4. The Teacher Runs The Computer

5. Relationship Between Teacher And The Program

GUIDELINES

The aims and objectives of CAI must be made crystal clear to each individual in the class.

Teachers must preserve their originality.

It is recommended that the course not be taught unless the equipment is on site.

After one demonstration, during which the students were permitted to use the equipment, a 100% improvement in comprehension and achievement were noted.

Communication between the instructors must be excellent if the aims and objectives of the course are to be attained.

We had two instructors, one a psychologist, the other a programmer. The programmer was working for IBM and hence did not have the time to meet his fellow instructor. If the liaison between these two instructors had been closer, many pitfalls could have been avoided.

The number of formal lectures in psychology should be kept to a minimum.

The psychologist would be retained as a counselor, a guide and a consultant.

It should be emphasized that the use of CAI will not make the life of the teacher any easier, but it will help the good teacher do a better job.

The teacher must keep in mind that CAI is just a tool used by him or her to transmit information, knowledge or skill. The teacher must preserve his or her individuality and originality.

Some provision must be made for having children ask questions as well as answer them.

The instructor must feel perfectly at home in using this medium of instruction.

Variation in the time intervals separating stimulus feedback and response.

Drill work carried on by means of both pictorial and auditory stimuli.

The size of the learning step will have to be determined by several factors.

The visual presentation will have to be changed for individual pupils to correspond to the individual differences.

An overview should be presented to the pupils before each lesson. This can be given to the group or to the individual student.

If at all possible a short interview should take place after each lesson either by the teacher or specially appointed monitors.

It must be emphasized over and over again that the computer does not make the decision. It is the decision of the programmer or the teacher or whoever supplied the data that led the computer by a sequence of logical branches to this or that particular determination.

Cues should not only be given by means of pictorial stimuli but also by aural stimuli either from the tape records or by the teacher.

It is recommended that the teachers build up their own programs rather than depend upon "canned lessons". In this way, variety, originality, and continuity will be preserved. In this way, too, CAI will become a time psychological link between the teacher and the pupil.

A system of elements or building blocks should be set up. These elements should be repeated time after time.

The psychologist should be acquainted with basic concepts of the computer.

The programmer could assist the psychologist by presenting him with a prepared schedule of his intended instructions for the entire course, session by session.

CAI will afford educators and educational research people an opportunity to delve productively into the process whereby humans learn.

By having teachers write their own programs, we can avoid the hardening into a fixed form which occurred under commercial pressure in Programmed Instruction.

There will be many successful programs and quite a few unsuccessful ones, but working with other teachers, a programmer and a psychologist, the teachers will have an opportunity to avoid many pitfalls.

Indeed it will be too much work for one teacher working by himself to get out just one semester's work in one subject. It is important to make the CAI program as flexible as possible - in fact, to approach the flexibility of the teacher.

Teachers will find no assured way of knowing whether a particular program will work or not. Pupils will like some lessons and be disappointed in others. It will be a case of trail and error. The principle job of the director of such a program is to keep up the enthusiasm of the teachers.

Pupils will be disappointed to learn that this new technique offers them no guarantee of easy and painless learning.

There is an important relationship between the teacher and the program. It is our belief that the more highly motivated the teacher, the better the work the students will do.

A program such as this lends itself very readily to team teaching provided all the teachers are equally enthusiastic about CAI.

Teachers will have to be disabused of the idea that blind faith in a sterotyped form of programming will give them successful projects.

The program must be designed in such a way that it can be adaptable to a particular student's capabilities and interests and help to develop understandings of the sort he he seeking.

A student uses a textbook to do work at home. He expects re-enforcement to come in one lump sum when he talks about it the next day. But when a student is using CAI, working on his own, he receives immediate feedback.

The teacher's role is going to be one of diagnosis and evaluation. In addition it will be that of a discussion leader who leads students to express the insights they have gained and to express this in the growing light of perceptions and insights that come from other people. The discussion enables each student to see the error or strength of his own reasoning.

SYNOPSIS OF STUDENTS' COMMENTS

"Interesting, beneficial and challenging. Psychology was essential for those teachers who will be working with the retarded or slow learners. .....Psychologist should be engaged as a consultant. Formalized lectures failed to point up specific application to CAI techniques for the retarded or slow learner. .....Greater use of Coursewriter would enhance the appreciation and understanding of its practical application. .....Outline of course and more information".

"Gained knowledge of basic fundamental theories concerning Coursewriter. .....Drop psychology. Spend more time on Coursewriter. .....Specify aims, goals and objectives in detail. .....Explain the relationship between psychology and CAI in area other than special education. .....Psychologist on consulting basis".

"Mr. Reynolds did an excellent job during lab periods. .....25% of class time with class instruction, 75% lab work similar to that conducted by Mr. Reynolds. .....More use of IBM machine".

"Amazed at the versatility of CAI. .....More emphasis on practical aspect of programmed instructions. .....Skip educational psychology".

....."I consider myself fortunate to be exposed to this future method of teaching. .....Equipment should be made available. .....More detailed outline of course should be expected from each".

"Instructors did a good job. Psychology too basic first four weeks. Psychologist should be available for consulting purposes. .....Emphasis on lab work".

"Learned Coursewriter, and with manual, can proceed from there. .....Psychologist did not connect his theories with our avowed purpose in CAI. .....Stress on mastering Coursewriter".

"More coordination. More general information about course, etc. .....The connection between Educational Psychology curriculum planning is quite evident, but was not coordinated this summer".

"Not sold on the practicability of this type of training, but am more than willing to test it. .....Trip to IBM office to check latest and contemplated equipment. .....Lack of information to students before beginning the course".

"On the whole, Coursewriter was a new and exciting experience for me. Possibilities offered are almost limitless. .....Lack of equipment. .....Not sufficient background in the Coursewriter. .....Orientation to entire program. .....Consulting psychologist".

"Course seemingly has great potential. .....Psychology portion of the program is questionable. .....The significance or relation between the two was not demonstrated. .....Outline and specifics at the beginning of course".

"Lack of machinery and practical application hindered learning. .....Formal Psychology is unnecessary. .....Concentrate on the technical aspects of programming and leave the psychology of teaching as an assumed fact. We here are supposed to be professional teachers and I feel that the authorities should assume we know how to teach. If the individual teacher needs more work in psychology, he should seek it on a personal basis".

....."Less formalized psychology classes and more computer work".

REACTION TO COURSE:

I have found the Computer Assisted Instruction course interesting, beneficial and challenging.

Business education today is affected by automation and other inventions that are bringing equipment along with new systems into business offices which do away with low skill and low-level jobs. By using the computer for instructions and testing, it will not only acquaint the student with automation but also alleviate any fear or apprehension of automated equipment.

I do feel, however, that too much valuable course material was crowded into this course in too short a period of time. I do agree that Psychology (process of learning) was essential as part of the course to enable those teachers who will be working with the retarded or slow learners.

The instructor gave us valuable and fruitful information; his lectures were instructive and informative. However, it would be most advantageous if the Psychologist could be engaged as a Consultant for the Computer Assisted Instruction as unit lessons are being developed and as a teacher would be working with a student.

Formalized lectures failed to point up specific applications to CAI techniques for the retarded or slow learner.

Time spent in ferreting out psychological theories detracted from specific applications of the theories to the Coursewriter.

Although the CAI INSTRUCTOR, who is to be commended highly, was dynamic, informative and complete -- greater use of a Coursewriter would enhance the appreciation and understanding of its practical application.

GUIDELINES FOR FUTURE COURSES:

For a six weeks' course, I felt that there were actually three courses compressed into one. e.g. --

1. Psychology
2. Mechanical features and operation applicable to the Coursewriter
3. Coursewriter language and procedures for lesson preparation

1. There should be a greater percentage of the practical application of the CAI (Coursewriter) in addition to the theory.

2. A brochure should be drawn up which contains complete course description, eligibility of enrollees, stipulations and limitations of stipends, length of course and requirements, method of stipend disbursements, application procedures, type and number of credits allowed.

3. Orientation to the Coursewriter.

4. Program instruction techniques of actual classroom subject content.

    a. Live lecture demonstrations by the instructor using other than classroom personnel.

    b. Techniques for independent student participation.

    c. Application and limitation of Coursewriter.

    d. Method of evaluating student progress in use of Coursewriter.

5. Psychologist to be engaged as a Consultant.

REPORT - "TOPICAL OUTLINE OF WHAT YOU THINK THIS REPORT SHOULD CONTAIN".

1. Number of teachers enrolled in the CAI workshop.

2. Unit of work (that is, title and description of the project) submitted by each individual or group.

3. Purpose of the unit of work.

4. To whom the unit of work will be applied and what grade level.

5. Type of student or students with whom one will be working.

6. Evaluation of teacher's project.

7. Psychologist's report giving description of course and requirements.

8. CAI Instructor's report giving description of course, material covered and tests administered; demonstrations given.

9. Guidelines submitted by enrollees, if constructive for future courses.

10. Report from the Director of the Computer Center on the accomplishment of each enrollee and how future enrollees will benefit from the CAI course.

.....submitted by
LUCY D. MEDEIROS
August 16, 1965

COMPUTER ASSISTED INSTRUCTION AND TIME-SHARING

The growth of CAI will depend to a great extent on the emergency of the time-sharing computer. Time-sharing really is a misnomer, we should say facilities sharing or multiple access computer. Sharing connotes an inconvenience, such as sharing a home, or limited office space. Here we are talking about something altogether different, something new.

The new III generation machines will incorporate large memory banks and extremely fast central processors that will operate in nano second time. Master control programs will run the computer and direct many programs simultaneously. The computer will present the same face to each of the students in many classrooms in different schools and will give the same results to each one just as if each pupil was operating his own giant computer.

The economic superiority of such a concept over the way computers have been used in the past decade is quite obvious. To equip each school with a computer would be an intolerable financial burden for many school systems. A III generation computer with data links will produce superior results at a lower cost per operation than a medium or small scale computer. Its rental price will be in a range that most school systems can afford.

For years the computer manufacturers and the leaders of the educational world have shut their eyes to the possibilities of the use of the computer in the schools. Now that the III generation of computer with data links is a reality and is available at a price most school systems can afford, perhaps we will be able to stem to a small degree the tremendous waste of human resources that goes on in many classrooms. The words "providing for individual differences" have been a catch phrase up to the present. With CAI we can truthfully allow a child to keep his own pace in the acquisition of knowledges, skills and understandings.

CAI is no cure all. It will not make a good teacher out of a poor teacher, but it will help the good teacher do a better job. It can also help to restore a certain dignity, prestige and professionalism to the teaching profession. No longer will he or she have to parade the aisle with a mark book held in a tightly clenched fist, the computer will take care of the marks. The teachers will simply have to evaluate them.

It has long been recognized that for new material to be firmly remembered by students it is important to reinforce it. Repetition in various forms is an obvious reinforcement technique....necessary in some instances....detrimental in others. Programed learning sets out to achieve reinforcement by a reward intrinsic to learning. With those who learn the most, the pleasure of learning itself (function pleasure; contentment arising from mastery) has proved to be the most effective reward. With the brain-injured, neurologically-impaired, or otherwise learning-handicapped child ....some function pleasure, some contentment will be experienced; but in the more complex situations, older and more concrete reward and reinforcement systems will be necessitated.

Some of the intrinsic features of "machine operation" will itself prove a source of fascination, motivation, and pleasure. In many individual cases, the affective loading of interpersonal relationships....prior to coming to school....has been so negatively charged that the child refuses to enter into a relationship with the classroom teacher....or with other pupils. Both of these have utilized as motivational sources in so-called "normal" classes. They have been tried and found ineffective in many (too many) cases in the "Special" classroom. The teacher's role is of unquestionable importance, as Biber indicates:

> "If emotional processes are to become active elements of the learning experience, education must take the responsibility of providing intergrating mechanisms and relationships. Integration can be expected to take place only to the extent that dynamic processes of identification, adaptation, objectification, self-awareness, and self-discovery are made possible. Such processes can be mediated partly through the structure and quality of the educational milieu, but more significantly through teacher-figures, who can enact balanced roles of support, control and stimulation."

Given the present state of teacher training in such areas, and given the known characteristics of rigidity, resistance, and inflexible habituation of the retarded as an overall group, it seems obvious that the teacher requires much in the way of assistance in order that the goals of the educational process can be met with any reasonable degree of perfection.

For the present, then, the very fact that the child is confronted with a mechanism which he "controls" rather than an adult model whom he fears or rejects for other causes....is a major initial contribution to Special Education and a major advantage in motivating the "unmotivated".

Since incorrect response may be learned in the interpersonal learning situation, it is of advantage to make correct responses immediately available to the learner. Programming can make it virtually impossible for incorrect responses to become encysted and habituated or perseverated. In the matter perseveration, long regarded by many as a handicap of the retardate, especially the child with organic involvement, it CAN be capitalized upon as a teaching aid. More particularly, since repetitive reinforcement will be necessary at times with handicapped learners, the "patience factor" of the human teacher can be replaced with the infinite patience and availability of the same materials, same stimulus situations, etc., as a computer can provide them. Short tempers, negatively-loaded affective cues, all of the temptations to which humans fall subject....can be eliminated from this aspect of the learning situation. Mastery can be acquired according to the limitations of the learner....no one will be "disappointed" and, therefore, no further blunting of the learner's sensitivities is required in order that he can maintain his psychic balance at the expense of environmental involvement.

Nothing succeeds like success. An aphorism widely applied as a general soporific....yet true in the ultimate. So, too, in the learning situation, initial failure leads to a withdrawal of energies and committment to the situation in which further insult is offered the already poor self-concept of the retardate. Computer Assisted Instruction makes possible a wide variety of ways in which initial successes can be structured. Failure can be eliminated....and most important, FEELINGS of failure,

so detrimental to future learning can be eliminated. The affective sphere of "conditioning for learning", of at least making the learner environmentally accessible, can be easily and efficiently managed by computer technique in a manner which does not rely on the strength of frail humanity....which does not permit of "bad days" or "blue Mondays" on the part of the instructor.

A necessary part of all learning is involvement of the learner's sensory response modalities. Multiple sensory stimulation in the ideal situation for effective learning of presented materials. The flexibility of computer systems, the possibilities for simultaneous operations of slide projectors, opaque projectors, tape recorders, verbal, printed and graphic instructional materials....leads to a whole new era in intellectual stimulation, by stimulation of the entire organism's sensors at a given moment in time. Again, the process of reinforcement is significantly enhanced by multiple sensory stimulation. Learning is literally inescapable and mastery is much sooner and more realistically achieved through whatever sense mode is most accessable. Neural paths which are exposed to excitation from a number of sources should reasonably be expected to be more conditioned to a state of "readiness" than has been possible to date. Tactile, auditory, and visual stimulation of the handicapped child is bound in logic to be more efficacious than attempts made heretofore.

The need seems to become more obvious as utilizations of the possibilities suggested in CAI programs are explored and dreamed upon for a highly trained, flexible teacher who can manage these materials and the youngsters for whom they will be developed. As such programs become a reality, as such materials become available, the classroom teacher can grow with the student in flexibility, comfortable relationship with the learning process and its attendant situational stresses, and in enthusiasm for progress. In short, the teacher, as the individuals in the group progress, can be ready to accept the necessary demands for interpersonal relationships which will grow from mastery of impersonal tasks and promote sufficiently healthy ego-structures that relationships with peers and teachers will no longer suggest impossibility of achievement and certain failure and disappointment.

Kirk and others have long found that in the end-product of special education programs....the adult worker....there has been a noted difficulty in vocational adjustment. Inability to learn job tasks was not the reason for job failure and job leaving ....rather a matter of attitude and emotional adjustment was involved. An end product of CAI, could very well be improvement in this area.

After experiences of mastery, leading to contentment, the learner would no longer automatically fear and withdraw from NEW experiences. Having demonstrated he is as good as the next learner, he would not need to refuse the interpersonal relationships upon which attitudinal construction is based. In the more severely handicapped cases, programmed attitudes are not an unrealistic thought. Slogans do have value, and if slogans are necessary to replace faulty symbol-spreads; if slogans are necessary to replace inabilities in the learning of multiple-discriminations....they can be readily provided....through programming, through computer-directed multiple sensory-stimulation.

In Tyler's view, all effective teaching-learning situations must be logically defined prior to commencement of any applications. His formula:

$$0=b+c$$

> wherein 0 objectives of the program, b behaviors to be elicited, and c content areas in which the behaviors are to be centered

has ample application, then, to CAI and future planning for its development through experimentation.

As an example, 0=b+c

	....has been defined in terms of		
0			
To develop skill in discrimination of forms, prior to exposure to Basic Reading experiences	b	and	c
	skill in discrimination		of geometric for

An application, then, of Gestalt principles of organization of percepts is utilized in order that the handicapped learner may begin to learn the principles of discrimination from easily discerned geometric shapes, distinguished as TRIANGLES, CIRCLES, SQUARES....the qualities of each being dramatized by color differentiation, and an identification of each, with a verbal description of its properties being supplied on tape....a very basic, but logical step in the approach to READING, a multiple discrimination skill which must be based on previously learned discriminative skills. Multiple sensory stimulation, repetition, direct reinforcement, learner involvement in the learning situation by means of learner executions of gestalten provided....are all possibilities which can be more effectively managed through CAI applications.

A project of this nature obviously requires a lengthy period of application of principles, a careful evaluation (managed along the lines of Tyler's 0=b+c), replication in several aspects with differing groups, and of course, continuity of application in order that any "Hawthorne effect" be nullified and the effectiveness of the CAI approach be evaluated in differentiated aspects. A two-to-three year time base seems realistically minimal in order that several groups of teachers be prepared to handle this technique efficiently and in order that individualized programs might be evaluated on the basis of eventual generalization and curriculum construction based on observed needs rather than a "watering down" of the traditional methods.

PROVIDENCE COLLEGE

COMPUTER ASSISTED INSTRUCTION

ANALYZING A BEGINNING BALANCE SHEET

Bookkeeping and Accounting Equation

Submitted by

LUCY D. MEDEIROS
August 16, 1965

Lucy D. Medeiros
Computer Assisted Instruction
PROVIDENCE COLLEGE

BASIC FUNDAMENTAL BOOKKEEPING AND ACCOUNTING EQUATION

START

1 rd Now that you have acquired a knowledge of the fundamental bookkeeping
2 equation, Assets=Liabilities+Proprietorship, the following balance
3 sheet will be used by you in answering questions applicable to the
4 analysis of a beginning Balance Sheet.

5 **Analyzing a Beginning Balance Sheet**

6 **Wood Realty Agency**

7 **Balance Sheet**

8 **October 1, 1962**

9	**Assets**		**Liabilities**	
10	Cash	491.00	Adams Company	275.00
11	Automobile	2180.00	McIntyre Company	342.00
12	Office Furniture	745.00	Triangle Motors	780.00
13	Office Machines	236.00	Total Liabilities	1397.00
14			**Proprietorship**	
15			M. W. Wood, Capital	2255.00
16	Total Assets	3652.00	Total Liab. and Proprietorship	3652.00

17 In each of the following sentences, select the phrase or amount that
18 best completes the statement. Give the letter corresponding to the
19 phrase or amount selected. Use capital letters. The first item, (0)
20 is given as an example.

```
21      The total liabilities of the Wood Realty Agency as shown on the balance
22      sheet are
23      (A)  $3,652.00      (B)  $41,397.00      (C)  $2,255.00
24      The correct answer is (B)
25      You are now ready to proceed with the analysis of a Beginning Balance
26      Sheet.  I am sure that you will do exceptionally well.  Good Luck.
Ch 1 qu 1
 1 qu   The name of the business for which the balance sheet is prepared is
 2      centered
 3      (A)  on the first line at the top of the form
 4      (B)  at the top of the left-hand section of the balance sheet
 5      (C)  at the top of the right-hand section of the balance sheet          EOB
EOB
 6 ca   A
 7 cb   a
 8 un
EOB
 9 un
10 br   Ch 1 qu 2                                                              EOB
EOB
11 Ch 1 qu 2
 1 qu   The words "Balance Sheet" are written on
 2      (A)  the same line as the name of the business
 3      (B)  the line above the name of the business
 4      (C)  the line below the name of the business
 5 ca C
 6 cb c
 7 un                                                                           EOB
EOB
 8 un
 9 br Ch 1 qu 3
EOB
10 Ch 1 qu 3
 1 qu   The date of the balance sheet is written on
 2      (A)  the first line of the heading of the balance sheet
 3      (B)  the second line of the heading of the balance sheet
 4      (C)  on the third line of the heading of the balance sheet
 5 ca C
 6 cb c                                                                         EOB
 7 un
EOB
 8 un
 9 br Ch 1 qu 4
EOB
10 Ch 1 qu 4
```

```
 1 qu    The first item listed on the left-hand side of the balance sheet
 2       illustrated above is

 3       (A) the amount to be collected from a customer
 4       (B) the amount to be paid to a creditor
 5       (C) the amount of money on hand                                  EOB
EOB
 6 ca C
 7 cb c
 8 un                                                                     EOB
EOB
 9 un

10 br Ch 1 qu 5                                                           EOB

EOB

11 Ch 1 qu 5

 1 qu    The second amount on the left-hand side of the balance sheet
 2       illustrated above is
 3       (A) the value of the automobile owned by the business
 4       (B) the amount still owed on this automobile
 5       (C) the down payment on this automobile                          EOB

EOB
 6 ca A
 7 cb a
 8 un                                                                     EOB

EOB
 9 un

10 br Ch 1 qu 6                                                           EOB

EOB
11 Ch 1 qu 6

 1 qu    The first amount on the right-hand side of the balance sheet
 2       illustrated above is
 3       (A) an amount to be collected from a customer
 4       (B) an amount owed to a creditor
 5       (C) the net worth of the proprietor                              EOB

EOB
 6 ca A
 7 cb a
 8 un                                                                     EOB

EOB
 9 un

10 br Ch 1 qu 7                                                           EOB

EOB
11 br Ch 1 qu 7
```

```
 1 qu   The total assets of the Wood Realty Agency as shown on the balance
 2      sheet are
 3      (A) $3,652.00      (B) $1,397.00      (C) $2,255.00                  EOB

EOB
 4 ca A
 5 cb a
 6 un                                                                       EOB

EOB
 7 un

 8 br Ch 1 qu 8                                                             EOB

EOB
 9 Ch 1 qu 8

 1 qu   The value of Mr. Wood's investment in the Wood Realty Agency as shown
 2      on the balance sheet is
 3      (A) $491.00      (B) $3,652.00      (C) $2,255.00                   EOB

EOB
 4 ca C
 5 cb c
 6 un                                                                       EOB

EOB
 7 un

 8 br Ch 1 qu 9                                                             EOB

EOB
 9 Ch 1 qu 9

 1 qu   The amounts on the balance sheet of the Wood Realty Agency that prove
 2      that the balance sheet is in balance are
 3      (A) $3,652.00      (B) $1,397.00      (C) $2,255.00                  EOB

EOB
 4 ca A
 5 cb c
 6 un                                                                       EOB

EOB
 7 un

 8 br Ch 1 qu 10                                                            EOB

EOB
 9 Ch 1 qu 10

 1 qu   Double lines are ruled across the amount columns on each side of
 2      the balance sheet
 3      (A) above the amount of the total assets
 4      (B) on the same line on both sides
 5      (C) on a different line on each side                               EOB

EOB
 6 ca B
 7 cb b
 8 un                                                                       EOB
```

EOB

9 un

10 ty You are to be commended for your interest, attention and cooperation.

You may have a few minutes to look over your responses.

PROBLEM 2

START

1 rd You may now proceed to Unit B -- Classifying Items for a Balance Sheet

2 Classify each item listed by typing the correct answers.

3 For example: A - if the item is an Asset

4 L - if the item is a Liability

5 P - if the item is Proprietorship

6 The first item, Cash on hand, is given as an example.

7 0. Cash on hand

8 A is the correct answer.

9 Please depress the response key.

CH 1 qu 11 EOB

EOB

1 qu Automobile we own
EOB
2 ca A
3 cb Asset
4 cb asset
5 cb Assets
6 cb Asset
7 cb a

8 un EOB

EOB
9 un

10 br Ch 1 qu 12

11 ch 1 qu 12

1 qu Owed to Adams Company EOB

EOB

2 ca L
3 cb Liability
4 cb liability
5 cb liabilities
6 cb Liabilities
7 cb l
8 un
9 un
10 un EOB

EOB
10 br Ch 1 qu 13 EOB

11 Ch 1 qu 13

1 qu Unpaid meat bill EOB

EOB

2 ca L
3 cb l
4 cb liability
5 cb liabilities
6 cb Liability
7 cb Liabilities
8 un
9 un
10 un EOB

EOB

11 br Ch 1 qu 14

12 Ch 1 qu 14 EOB
EOB

1 qu Office furniture EOB

EOB
2 ca A
3 cb a
4 cb asset
5 cb assets
6 cb Asset
7 cb Assets
8 un
9 un
10 un EOB

EOB
11 br Ch 1 qu 15 EOB

EOB
1 qu Owed to grocery store EOB

EOB
2 ca L
3 cb l
4 cb Liability
5 cb Liabilities
6 cb liability
7 cb liabilities
8 un
9 un
10 un EOB

```
EOB
11  br Ch 1 qu 16                                                    EOB

EOB
 1  qu   House we own                                                EOB

EOB
 2  ca A
 3  ca a
 4  cb Asset
 5  cb Assets
 6  cb asset
 7  cb assets
 8  un
 9  un
10  un                                                               EOB

EOB
11  br Ch 1 qu 17                                                    EOB

EOB
 1  qu   Government bonds on hand                                    EOB

EOB
 2  ca A
 3  cb a
 4  cb Asset
 5  cb Assets
 6  cb asset
 7  cb assets
 8  un
 9  un
10  un                                                               EOB

EOB
11  br Ch 1 qu 18                                                    EOB

EOB
12  Ch 1 qu 18

 1  qu   Any item we own                                             EOB

EOB
 2  ca A
 3  cb a
 4  cb Asset
 5  cb Assets
 6  cb asset
 7  cb assets
 8  un
 9  un
10  un                                                               EOB
```

```
EOB
11  br Ch p qu 19                                                    EOB
EOB
12  ch 1 qu 19

 1  qu    Any item we owe                                            EOB
EOB

 2  ca L

 3  cb l
 4  cb Liability
 5  cb Liabilities
 6  cb liability
 7  cb liabilities
 8  un
 9  un
10  un                                                               EOB

EOB

11  br Ch 1 qu 20

EOB
12  ch 1 qu 20

 1  qu    The amount of the difference between total assets and total liabilities.  EOB

EOB
 2  ca P
 3  cb p
 4  cb proprietor
 5  cb proprietors
 6  cb proprietorship
 7  cb capital
 8  cb ownership
 9  un
10  un                                                               EOB

11  ty    All areas of business must keep in step with the continually changing
12        training requirements brought about by dynamic changes in technology.
13        Business education today is affected by automation and other inventions
14        that are bringing equipment along with new systems into business
15        offices which do away with low skill and low-level jobs.

16  qu    If you enjoyed and benefited by learning the basic accounting principles
17        projected by this machine, would you kindly answer by typing yes or no.
          with either answer, please give a brief reason.

18  ca    Yes

19  ty    Congratulations.  I'm sure that some day you will be one of the workers
          qualified to be employed in an office that is equipped with electronic
          data processing equipment.
```

20 wa No

21 ty Too bad. I advise you to do some research regarding automated offices.
22 Businesses needs in the automated work-a-day-world for workers are
23 growing, but these needs can only be met by competent workers. I'm
24 sure that some day, at the end of the course, perhaps, you will agree.

25 Good Luck

26 Sign Off

End

The Electric Circuit

E. Sherlock
E1965

Sign On
E19651 (student number)
John Johnson (student name)
Control words Start EOB cr
Begin EOB cr

ch1 qu1

```
 1  rd   This course will contain information pertaining to an electric
 2       circuit.  operate R key.
 3  qu   An electric circuit is a complete path thru which electrons may
 4       flow.  Read statement three times, when finished operate R key to
 5       start quiz.
 6  qu   An electric circuit must have a complete —— for electrons to
 7       flow.  Your answer does not require punctuation, capitals, or
 8       spaces.
 9  ca   path
10  fn   Editls//sh
11  ca   circuit
12  fn   Editls//sh
13  ty   correct
14  wa   wire
15  wa   run
16  wa   line
17  ty   incorrect
18  un   This term is associated with an electric circuit but the correct
19       term is path.  Please type path.
```

qu2

```
20  qu   There are four necessary parts for an electrical circuit.  The
21       first part of an electrical circuit is the load or current
22       consumer which is the reason we have an electrical circuit.
23       Signal you understand this statement by operating R key.
24  qu   The —— is the first part of an electrical circuit you have
25       learned
26  ca   load
27  fn   Editls//sh
28  ca   current consumer
29  fn   Editls//sh
30  ty   correct
31  wa   lamp
32  wa   motor
33  wa   resistor
34  ty   incorrect
35  un   This appliance is a current consumer and acts as a load in a
36       circuit, but would not be the correct term to use.  Load is a
37       term used to define a device that dissipates electrical energy.
38       Print answer.
```

```
qu3

39 qu  The second part of an electrical circuit is the source of
40     electrical energy, such as a generator or a battery.  Signal
41     you understand the statement by operating R key.
42 qu  What is the second part of an electrical circuit?  Please answer
43     with one word.
44 ca  source
45 fn  Editls//sh
46 ca  battery
47 fn  Editls//sh
48 ca  generator
49 fn  Editls//sh
50 un  When work is done, energy is expended, therefore electrical
51     energy is being used when electrical load is placed on a
52     circuit.  The two devices used as a source of this energy are
53     the generator and the battery.  Try again, watch your spelling.

qu4

54 qu  The third part of an electrical circuit is the path thru
55     which electrons move from one end of the source to the other
56     end of the source.  Conducting paths are usually copper insulated
57     wire, please operate R key when statement is thoroughly under-
58     stood.
59 qu  What metal is in common use as a conducting path for an electric
60     circuit?
61 ca  copper
62 fn  Editls//sh
63 ca  copper
64 fn  Editls//sh
65 ca  aluminum
66 ty  correct
67 un  As in a city water distribution system there must be conductors
68     to allow the water to flow in main arteries thru branches to the
69     consumer, an electrical distribution must have conducting paths.
70     The conducting paths in an electrical distribution are the
71     copper or aluminum wires secured to insulators installed on arms
72     fastened and braced to the top of utility poles.

qu5

73 qu  The fourth part of an electrical circuit is necessary because
74     we must have some means of controlling the electron flow, a
75     switch is used for this purpose.  A switch opens the circuit
76     when the appliance is not in use.  The switch closes the circuit
77     when the appliance is to be used.  Please operate R key if
78     statement is understood.
79 qu  A ——— is used to control electron flow in an electric circuit.
80 ca  switch
81 fn  Editls//sh
82 ca  switch
83 fn  Editls//sh
```

84 ca switch
85 fn Editls//sh
86 ty correct
87 wa control
88 wa disconnect
89 un This word fits the statement, but is not a six letter word
90 which was required. Try again.
91 rd Sign off

This course requires a slide projector to be inserted after each rd. The slide will have illustrated material with captions.

CALCULATING AND ESTIMATING

PAPER COSTS

Graphic Arts 12

A Course using Computer-Assisted Instruction

Gerald W. Ridge

Part I

Basic Reading Material

Part II

Program in Coursewriter

CALCULATING AND ESTIMATING PAPER COSTS — Graphic Arts 12

Basic Reading Material

Section 1

BASIC SIZE:

This is the most common size in which a particular kind of paper if sold. It is the size upon which weight and cost calculations are based. Basic sizes vary with the type of paper. Each of the major classes of paper has its own basic size. For example, the basic size for bond paper is 17 x 22". Below is a summary of the basic sizes of some common types of paper:

Bond 17 x 22"
Book 25 x 38"
Cover 20 x 26"
Mill Bristol 22 1/2 x 28 1/2"
Index Bristol 25 1/2 x 30 1/2"
Newsprint 24 x 36"

Section 2

STANDARD SIZES:

These are popular sizes of paper, sold in addition to the basic size. They are usually multiples of the basic size. One may find bond paper being sold in 17 x 22" (basic size), as well as the sizes below:

17 x 28"
28 x 34"
34 x 44"
17 1/2 x 22 1/2"
22 x 34"

A closer study of these sizes will reveal that they are not arbitrary. They are manufactured and sold because printers want these sizes also. See how much more economical it is to cut an 8 1/2 x 14" piece out of a sheet 17 x 28", than the 17 x 22" basic size. The estimator can appreciate these alternate sizes when he is planning and estimating jobs in nonstandard sizes. A 17 1/2 x 22 1/2" size is made for the printer who wants to print 8 1/2 x 11" letterheads four-up, and still have a little margin for bleed and trim. Some merchants sell a 19 x 24" size for the printer who wants to run a book type of job of 6 x 9" on a bond paper, instead of the more efficient book paper size.

Section 3

BASIC WEIGHT:

This is a standard comparison of weight between various types of papers. It is always determined by using the basic size of the paper. It means the weight of 500 sheets of a given paper (basic size). That is, if one counted out 500 sheets of a given paper, being sure to use the basic size, and weighed them, the result would be the basic weight. This is controlled at the paper mill by adjusting the paper's thickness and additives. If you bought 500 sheets of 17 x 22" 20-pound bond paper, and weighed them, they would weigh 20 pounds. If the mill rolled the paper thinner, so that 500 sheets weighed 16 pounds, it would be designated and labeled as Bond, 16 pound.

Section 4

SUBSTANCE:

This is a synonym for basic weight. It also means the weight of 500 sheets of paper of its basic size. Papers may be labeled Sub. 16, 16#, 16 pound, and all be the same weight.

Section 5

M WEIGHT:

For a long time printers bought and sold paper in reams (500 sheets). This was a traditional and convenient quantity. Today, most printing is ordered and sold by the 1,000. Therefore, many printers find it best to discuss the weight of paper in terms of 1,000 sheets, instead of the usual ream. This led to the usage of the M weight designation. The M weight means the weight of 1,000 sheets of paper, of the size in question. Notice that it is based upon the particular size in question, and not the basic size, as when determining basic weight. The M weight, rather than basic weight, is the preferred way of specifying paper, because it is not limited to comparisons of basic size.

A package of 17 x 22" paper which is labeled Sub. 20 (20 pounds per 500 sheets of the basic size), is the same as a package labeled 40M (40 pounds per 1,000 sheets). Thus a Sub. 20, a 20# and a 40M bond are all the same weight of sheet.

Section 6

CALIPER:

This a measurement of the thickness of a sheet of paper. It is stated in terms of "thousandths of an inch." Some paper merchants prefer the synonym "points". They would call a sheet of paper calipering four thousandths of an inch as "four-point" stock. (This is not the same point as used in the printers' point system for measuring type.)

In a sense, the basic weight of a sheet is dependent upon the caliper. If the mill rolls the sheet very thin, it will weigh little per 1,000 sheets. If it is rolled thicker, it will weigh more per 1,000 sheets.

An understanding of caliper, and how to determine it is useful to the estimator. With a pocket micrometer he can approximate the basic weight of the paper. The estimator has only to "mike" the thickness of the sheet, and refer to a paper price book to convert thickness to basic weight. For example, the bond paper shown in Figure 1 labeled .002 3/4" is actually a 13-pound basic weight stock. While the paper which calipers .003 1/4" is a 16-pound bond, and the .004" is a 20-pound bond. Finally the .004 3/4" sheet is a 24-pound bond. This extra bit of information will help the estimator to find the basic weight of an unknown stock from a sample.

Section 7

GRAIN:

Because of the nature of the manufacturing process, paper is produced which may have different qualities depending upon the direction in which it is folded or fed through the press. As paper is made, it rolls across a screen which interweaves the small cellulose fibers into a mat. These fibers tend to align into a pattern, parallel to the direction of the moving screen. After drying and sheeting, the paper will posess some interesting and critical qualities as a result of this alignment of fibers. The estimator must understand these qualities to be able to order paper that will fold and feed properly.

Long grain paper means that the grain is parallel to the long dimension of the sheet. Short grain means that it is parallel to the short direction. The estimator must know the direction of grain before he chooses a particular paper. The direction along which the grain runs is understood in the price book. (See Figure 1.) A sheet of 25 x 38 paper means the grain runs long, or parallel to the 38" direction.

Section 8

PRICING BRACKET:

This is the column under which the price of the paper will be determined. Most paper price books show a number of price columns, or brackets. These are based upon the number of cartons purchased on a single invoice. Because of billing and shipping economies, printers who can buy many cartons of paper at one time will pay less than a printer who buys only part of a carton at a time. Some common price brackets are 16 carton, 4 carton, 1 carton and less than a carton.

An alternate bracket arrangement is 2,000 lbs., 500 lbs., 1 carton and less than a carton. Again the determining factor is the number of cartons bought on a single purchase. The price book tells how many sheets are in a single carton, in a special column. (See Figure 1.) The estimator first figures how many sheets are required for the job, next determines how many cartons of paper he will order, and then finds the price bracket.

Section 9

AMALGAMATING FOR QUANTITY PRICE:

Amalgamation schedules have been set up in order to give printers the flexibility of mixing types of paper to obtain quantity prices. This table will define which papers may be grouped together in order to get the quantity price. (See Figure 2.) For example, all bonds, ledgers, mimeograph, manifold, onionskin, safety and writing may be grouped for quantity pricing. And all books, texts, label and nonfading poster may be mixed to get lower quantity price. However, a printer could not group a quantity of book paper and a quantity of bond paper to receive a lower price on both.

This brief and learned foray into the paper merchants' domain has revealed a few things. His jargon and methods may appear confusing, but are the result of printers' demands. He is willing to tailor his output to the printers' needs. And finally, an understanding of his vocabulary will help you read the road signs so that you won't get lost in paperland.

IBM CALCULATING AND ESTIMATING PAPER COSTS - Graphic Arts 12

Form X24-3336-0
Printed in U. S. A.

INTERNATIONAL BUSINESS MACHINES CORPORATION

Operating System for Computer-Assisted Instruction

Coursewriter Instruction Sheet
IBM 1401 and 1440

Course Name graphart 12
Author's Name Jerry Ridge
Author's Number a xxxx

Date 8-65
Page No. 1 of

Label or Sequence Number	Blank	Op Code	Blank	Course Material
Sign on				
graphart12				
xxxx				
Start1				
Start2				
1		rd		"Some printers with a view to save a few dollars per week, take into their service
				lads or men perfectly unacquainted with the business of paper, who, through
				ignorance or carelessness, fall into many serious mistakes." - J. Johnson +
2				Calculating and estimating paper costs have always been a problem to the printer.
				It is no less today than in 1824 when Johnson wrote the words above in his text
				on printing. The paper price catelog is a bewildering and complicated book. The
				modern paper price book reflects the demands of printers and stationers for
				countless varieties and types of papers. Paper has come to be sold by the pound,
				thousand sheets, ream, bundle and roll. Each requires a unique pricing procedure
				and therefore the format varies throughout the book. For precise and profitable
				estimating, the data encoded must be understood. This course will consider terms
				that should be made part of every printer's vocabulary and will enable you to use
				these terms in conjunction with the modern paper price book.
				Will you please type in End of Block code. +
Start3				
1		qu		Do you have the material kit including the basic reading material and the sample price
				price book? Answer yes or no.+
2		ca		yes+

641125CSP

Form X24-3336-0
Printed in U. S. A.

IBM

INTERNATIONAL BUSINESS MACHINES CORPORATION

Operating System for Computer-Assisted Instruction

Coursewriter Instruction Sheet
IBM 1401 and 1440

Course Name _____
Author's Name _____
Author's Number a _____

Date _____
Page No. 2 of ___

Label or Sequence Number	Blank	Op Code	Blank	Course Material
3		fn		edit 1s//all
4		ty		good. Remove the six samples marked basic sizesz and the basic reading material.+
5		no		
6		fn		edit 1s//all
7		ty		Sign off and procure one from your proctor.+
8		br		start3
Start 4				
1		rd		Study section 1 of the basic outline. When you finish signify by hitting E.O.B.
				(end of block) key.
Signqu1		qu		The basic size of bond paper is a) 25 x 38" b) 20 x 26" c) 17 x 22" d) 24 x 36"
2				Please use lower case (small) letter only for answer.
2		ca		c
3		fn		edit 1s//all
4		ad		+1//cn 1
5		ty		correct. 8 1/2 x 11" Bond letterheads cut 4 out exactly.
6		wa		a
7		fn		edit 1s//all
8		ad		+1//cn2
9		ty		Wrong. Standard letterheads cut exactly out of this size. Try again.
10		wb		b
11		fn		edit 1s//all
12		ad		+1//cn2

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Coursewriter Instruction Sheet

IBM 1401 and 1440

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Label or Sequence Number (1–10)	Blank (11)	Op Code (12 13)	Blank (14)	Course Material (15–65)
13		ty		Wrong. Standard letterheads cut exactly out of this size. Try again.
14		wb		d
15		fn		edit 1s//all
16		ad		+1/cn2
17		ty		Wrong. Standard letterheads cut exactly out of this size.
18		un		Incorrect response. Please use only the letter that preceedes the correct answer.
19		ad		+1/cn2
20		un		Please type in c. 17 x22" is the standard basic size for bond paper. The letter c
				preceeds it and is therefore the correct response.+
21		ad		+1/cn3
Signqu2				
1		qu		What stock is sold in the basic size 25 1/2 x 30 1/2?
2		ca		index bristol
3		fn		1s//all
4		fn		1a//all
5		ad		+1//cn1
6		ty		Correct. 3 x 5, 4 x 6, and 5 x 8 file cards cut out well.
7		wa		bond
8		fn		1s//all
9		ad		+1//cn2
10		ty		Incorrect. You just answered that bonds basic size is 17 x 22". File cards cut out well
				from this size (25½ x 30½). Try again.
11		wa		book

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Label or Sequence Number (1–10)	Blank (11)	Op Code (12 13)	Blank (14)	Course Material (15–65)
12		fn		1s//all
13		ad		+1//cn2
14		ty		Wrong. Book size is 25 x 38" Try again.
15		wb		millbristol
16		fn		1s//all
17		ad		+1//cn2
18		ty		Incorrect. Mill bristol's standard size is 22 1/2 x 28 1/2. Try again.
19		wa		Newsprint
20		fn		edit1s//all
21		fn		edit1a//all
22		ad		+1//cn2
23		ty		Incorrect. Newsprint's standard size is 24 x 36". Try again.
24		wa		bristol
25		fn		edit1s//all
26		ad		+1//cn2
27		ty		You are partly correct. What type of bristol? Type a two word answer. _____ bristol.
28		un		Try again. Use two words to describe this type of paper stock.
29		ad		+1//cn2
30		un		Try again. Use two words to describe this type of paper stock. The first word is index.
31		ad		+1//cn2
32		un		The correct answer is index bristol. Please type this in to continue.
33		ad		+1//cn3
Signqu3				

c/s

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Label or Sequence Number (1–10)	Blank (11)	Op Code (12 13)	Blank (14)	Course Material (15–65)
1		qu		Basic siae is the most common size in which a particular kind of paper is sold. How many 8 1/2 x 11" or 9 x 12" covers could be cut from a piece of standard cover stock?
2		ca		4
3		ad		+1//cn1
4		ty		Correct. Good, 20 x 26" will give at least 4 out up to size 10 x 13".
5		cb		four
6		ad		+1//cn1
7		ty		Correct. Good, 20 x 26" standard cover stock will yield up to four out to size 10 x 13".
8		wa		2
9		ad		+1//cn2
10		ty		You're incorrect. Perhaps you are not taking both dimensions into account. Try again
11		wa		two
12		fn		edit1s//all
13		ad		+1//cn2
14		ty		Incorrect. You are possibly not taking both dimensions into account. Please try again.
15		un		Wrong. Divide the dimensions of the required finished size into the standard size dimension in such a way to yield a maximum product. Try again.
16		ad		+1//cn2
17		un		Wrong. Here is a similar example. If the standard size were 25 x 38 and you were cutting 9 x 12 out, you would do as follows: 9 into 38 is 4 (whole number only). 12 into 25 is 2. The product of 4 x 2 is 8. 8 is the correct answer to this problem. If you tried 9 into 25 you would get but 2 and 12 into 38 is but 3. You would haye only 6 out. This answer is wrong because it is not a maximum; there would be too much waste. Now try the original problem will the cover stock.

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Label or Sequence Number	Blank	Op Code	Blank	Course Material
18		un		Perhaps you do not know the basic and standard size of cover stock. It is 20 x 26". Try again.
19		ad		+1//cn2
20		un		The correct answer is 4. 9 x 12 or 8 1/2 x 11" goes into 20 x 26 cover 2 and 2 yielding 4. Please type in 4.
21		ad		+1//cn3
Start 5				
		rd		Please sign off and read Section 2 of the course outline, "Standard Sizes". Then sign back on to continue.
Signqu4				
1		qu		Bonds basic size is 17 x 22". A standard size bond is 17 x 28". What common size document cuts from this. Please state the dimensions. Use the form ## x ##".
2		ca		8 1/2 x 14"
3		fn		edit1s//all
4		fn		edit1a//all
5		ad		+1//cn1
6		ty		Correct. This is called legal size.
7		un		Wrong. It cuts 4 out. Try again.
8		ad		+1//cn2
9		un		Wrong. The correct answer is 8 1/2 x 14" (Legal Size). Please type in 8 1/2 x 14".
10		ad		+1//cn2
11		ad		+1//cn3
Signqu5				

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Label or Sequence Number	Blank	Op Code	Blank	Course Material
1		qu		To get 8 1/2 x 11" standard letterheads with sufficient trim for a bleed (a run over the edge of the finished stock), what standard size would be used. Bond paper.
2		ca		17 1/2 x 22 1/2"
3		fn		edit1s//all
4		fn		edit1a//all
5		ty		Correct.
6		cb		17 1/2" x 22 1/2"
7		fn		edit 1s//all
8		fn		edit1a//all
9		ty		Correct. But next time enter all dimensions as follows: 17 1/2 x 22 1/2". Note that inch dimension occurs after the last dimension of the pair.
10		cb		17 1/2" x 22 1/2
11		fn		edit1s//all
12		fn		edit1a//all
13		ty		Correct. But next time enter all dimensions as follows: 17 1/2 x 22 1/2". Note that inch dimension occurs after the last dimension of the pair, Of course the 17 1/2 x 22 1/2" figures are just examples, not the answer to each suceeding question.
14		ad		+1//cn1
15		wa		17 x 22"
16		fn		edit1s//all
17		fn		edit1a//all
18		ad		+1//cn2
19		ty		Wrong. You are not allowing for bleed, i.e., image that runs off the sheet for effect. Try again.

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Label or Sequence Number	Blank	Op Code	Blank	Course Material
20		wb		19 x 24"
21		fn		edit1s//all
22		fn		edit1a//all
23		ad		+1//cn2
24		ty		You would have too much waste. Use a smaller size.
25		un		Wrong. Are you writing your dimensions as this example: 20 1/2 x 26 1/2". Try again.
26		un		Wrong. 8 1/2 x 11 cuts out 4 times with but a small trim from this size. Try again.
27		ad		+1//cn2
28		un		Wrong. 17 1/2 x 22 1/2" is the correct answer. Please type this in.
29		ad		+1//cn3
Start6				
1		rd		Please sign off to read section 3 of your outline: Basic weight. Sign on to continue.
				Now hit E.O.B. key.
Signqu6				
1		qu		Basic size and basic weight are related. Basic weight is weight of _____ sheets of a
				given paper (basic size). Please fill in the blank. Use figures.
2		ca		500
3		ad		+1//cn1
4		ty		Good. If 500 Sheets of 17 x 22" (Basic Size) bond paper weighs 20 lb, It is referred to as
				20 lb. bond.
5		ca		fivehundred
6		fn		edit1s//all
7		ad		+1//cn1

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Label or Sequence Number	Blank	Op Code	Blank	Course Material
1 10	11	12 13	14	15 20 25 30 35 40 45 50 55 60 65
8		ty		Correct. Please follow instructions better next time. You should have used figures.
9		wa		1000.
10		ty		Incorrect. Paper is now often sold by the 1000 or M, but this is not the answer. Try again.
11		ad		+1//cn2
12		wa		M
13		ad		+1//cn2
14		ty		Incorrect. 1000 is not the answer. Please use figures, not roman numerals.
15		un		The correct answer is 500. Please type this in.
16		ad		+1//cn3
17		br		remed1//c3//+5
remed1				
1		rd		You are not getting the material. It is important that you study your outline carefully.
				Read it once again. Then answer the questions once more. Hit EOB key.
2		br		Start4
Signqu7				
1		qu		500 sheets of 11 x 17" bond paper sub 20 weighs _____ lbs. Use figures. Type number only.
2		ca		10
3		ad		+1//cn1
4		ty		Correct. You are progressing well.
5		cb		10 10 lbs
6		ad		+1//cn1
7		ty		Correct. Please state only what is required next time. Thanks!
8		wa		20

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Label or Sequence Number (1–10)	Blank (11)	Op Code (12 13)	Blank (14)	Course Material (15–65)
9		ty		You have 11 x 17" paper which is half of 17 x 22", bonds basic size. Try again.
10		ad		+1//cn2
11		un		11 x 17" is not a basic size. Think of what part of bond's basic size it is and try again to answer the above question.
12		ad		+1//cn2
13		un		Incorrect. Basic size for bond paper is 17 x 22". 500 sheets of basic size, sub 20 bond paper weighs 20 lbs. Try again.
14		ad		+1//cn2
15		un		11 x 17" is half the basic size of bond paper (17 x 22"); hence 500 sheets of it would weigh half its basic weight. Try again.
16		ad		+1//cn2
17		un		Incorrect. Half of 20 lbs is 10 lbs. Please type in 10 and we will try a similar problem.
18		ad		+1//cn3
19		ty		Remember that in the next question that the basic weight given is the weight of 500 pieces of basic size.
80qnqu8				
1		qu		65 lb cover stock is used to produce 1000 10 x 13 covers. Basic size of cover stock is 20 x 26". What is the weight of the stock used?
2		ca		32.5 lb
3		ty		Correct. Good Job!
4		ca		32 1/2 lb
5		ty		Correct. Good Job!
6		cb		32.5 pounds
7		ty		Correct. Good Job!

BOND PAPERS

ARDOR BOND (Continued)

	Price per Cwt. 16 Ctns.	4 Ctns.	1 Ctn.	Less Ctn.
Blue, Buff, Canary, Goldenrod, Green, Pink—Sub. 13 & 16	26.50	28.50	31.10	41.50
Blue, Buff, Canary, Goldenrod, Green, Pink—Sub. 20	25.55	27.45	30.00	40.00

Sub.	Size	Wt. per M Shts.	Shts. per Ctn.	Price per 1000 Sheets			
*13	17 x 22	26	5000	8.48	9.12	9.95	13.28
	19 x 24	32	4000	10.34	11.12	12.13	16.19
	17 x 28	33	4000	10.87	11.69	12.75	17.02
	22 x 34	52	2500	16.96	18.24	19.90	26.56
	24 x 38	64	2000	20.67	22.23	24.26	32.37
	28 x 34	66	2000	21.73	23.37	25.50	34.03
16	17 x 22	32	4000	8.48	9.12	9.95	13.28
	17½ x 22½	34	4000	9.01	9.69	10.57	14.11
	19 x 24	39	3000	10.34	11.12	12.13	16.19
	17 x 28	41	3000	10.87	11.69	12.75	17.02
	22 x 34	64	2000	16.96	18.24	19.90	26.56
	22½ x 35	64	2000	17.76	19.10	20.84	27.81
	24 x 34	70	2000	18.55	19.95	21.77	29.05
	24 x 38	78	1500	20.67	22.23	24.26	32.37
	28 x 34	82	1500	21.73	23.37	25.50	34.03
20	17 x 22	40	3000	10.22	10.98	12.00	16.00
	19 x 24	49	3000	12.52	13.45	14.70	19.60
	17 x 28	51	3000	13.03	14.00	15.30	20.40
	22 x 34	80	1500	20.44	21.96	24.00	32.00
	24 x 38	98	1500	25.04	26.90	29.40	39.20
	28 x 34	102	1500	26.06	28.00	30.60	40.80

Approx. Caliper: Sub. 13—.002¾ Sub. 16—.003¼
Sub. 20—.004 Sub. 24—.004¾

*Sub. 13 billed as Sub. 16

For Cutting Charges See Page 2 This Section

—Usual Grain Direction

FIG. 1